ATR8000

CP/M™ SUPPLEMENT

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Printed in the United States of America

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This Supplement details CP/M and the ATR8000. It thoroughly describes the SWP ATR8000 CP/M programs and briefly covers the standard Digital Research CP/M programs and commands. For more specific information about the Digital Research CP/M programs, refer to their CP/M manual.

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I. Hardware Concerns

Instructions for connecting the ATR8000 system are in the ATR8000 Owner's Manual. This section contains information specific to running CP/M on the ATR8000.

I.1. Using an ATARI or an RS-232 Terminal

The 64k ATR8000 system runs CP/M either through an ATARI 800/400 or an RS-232 terminal. If the ATARI 800/400 is used, it is sent a terminal program, Auto-Term, during the CP/M boot procedure. After Auto-Term is run, the ATR8000 is the master processor in the ATR8000-ATARI system.

CP/M has an 80 character line width. On the standard ATARI 800/400, CP/M displays are shown in a movable 40-column window. SWP has a special Auto-Term program available for Bit 3TM 80-column owners that displays all 80-columns simultaneously.

RS-232 terminal users do not use the Auto-Term program. Terminals automatically display all 80 columns in CP/M. RS-232 terminals need to be 9600 baud, odd parity and 7 bits and they must emulate the ADM-31/Soroc/Televideo protocol.

I.2. Disk Drives

As explained in the ATR8000 Owner's Manual, the ATR8000 supports a wide variety of disk drives. As shipped, the 5 1/4" ATR8000 CP/M disk will boot on 35 track and 40 track single or double-sided drives. Users that only have 80 track (single or double-sided) 5 1/4" drives, need to get a special CP/M disk from their dealer or from SWP Microcomputer Products. Although the 5 1/4" CP/M disk will boot on 35 track and 40 track single or double-sided drives, the system tracks need to be customized if you are using anything but 40 track, single-sided drives. This is done using DDSYSGEN. Do any customizing before experimenting with CP/M.

As shipped the 8" CP/M disk is for 77 track single-sided drives. It will also boot on 77 track double-sided drives, but owners of these drives need to customize the CP/M disk. This is explained in the DDSYSGEN instructions.

Users that have a mixture of drive types, also need to customize their CP/M. This is done using DDSYSGEN.

As explained in the ATR8000 Owner's Manual, CP/M must be booted from Drive A and this must be a standard disk drive. Percom drives with the controllers intact and ATARI 810 drives cannot be used for CP/M.

I.3. Printers

Either a serial or a parallel printer can be used with CP/M. A parallel printer connects to the PRINTER Port; a serial printer connects to the RS-232 Port. The CP/M disk contains a parallel printer driver. This can be changed to a serial driver by using the symbolic patch function of DDSYSGEN to change location IIOBYT. This is is explained in the DDSYSGEN instructions.

The RS-232 Port is default configured for an Epson serial printer. If you are using a different type of serial printer, consult the ATR8000 Owner's Manual to properly configure this Port (using J12).

I.4. Modems

A modem can be connected to the RS-232 Port. The CP/M disk contains a multi-function modem program, MODEM.COM. Detailed instructions for this program are listed in the file MODEM.DOC. Use the TYPE command of CP/M to read this file. (To temporarily halt the display, type a <CTRL><S>. Another <CTRL><S> will restart it.) [The command is: TYPE MODEM.DOC<RETURN>; To print the file, enter a <CTRL><P> before pressing <RETURN>.]

RS-232 Port peripherals require the proper configuring of J12. Consult the ATR8000 Owner's Manual for details.

II. Booting CP/M

This section is divided in three parts. The first contains boot instructions for ATR8000-ATARI users, tells how to backup the Auto-Term disk, and lists the special keys that move the 40 column display window. The second contains boot instructions for RS-232 terminal users. The last tells how to backup the CP/M disk. **Backup your CP/M disk before experimenting with CP/M.**

II.1. Booting CP/M with an ATARI 800/400

Booting CP/M with an ATR8000-ATARI system is a two-step procedure. For CP/M, the ATARI turns over system control to the ATR8000 after it receives a terminal program, Auto-Term. After Auto-Term is active, CP/M is booted.

Step 1 Turn the power on the ATR8000 and the disk drives.

Step 2 The drives' motors will run for roughly 3 seconds. When the motors stop, insert the Auto-Term disk in Drive A and turn on the ATARI.

Step 3 If there isn't a BASIC cartridge in the ATARI, after a few seconds, "ATRMON" and its prompt "#" will show on the screen. Remove the disk.

If there is a BASIC cartridge in the ATARI, after a few seconds "READY" will show on the screen. Type: "DOS<RETURN>". The screen will show "ATRMON" and its prompt, "#." Remove the disk.

Step 4 Put the CP/M disk in Drive A. Type: "B<RETURN>". CP/M is now booted and its prompt "A>" shows on the screen.

II.1.A. Backing Up Auto-Term

The Auto-Term disk is an ATARI DOS disk. To back it up, do the following:

Step 1 From the ATARI DOS menu, format a disk that the backup copy will be written to. [Use the I option.]

Step 2 From the ATARI DOS menu, choose the J option to copy Auto-Term from the master to the backup disk.

II.1.B. Terminal Program Controls

Operating ATARI DOS or OSA+, the ATARI has a 40 column display width on the interfaced television's screen. Once the ATARI is being used as a terminal for CP/M, this display is a full 80 columns by 24 rows. The additional 40 columns are accessed by scrolling the screen display right and left. (As long as a television is used as a monitor there can only be 40 columns visable on the television's screen due to band width limitations.)

Think of the 40 columns shown as a 40 column wide window of an 80 character wide display space. Technically these 80 columns are referred to as Columns 0 - 79, rather than Columns 1 - 80. The normal position of the window shows the first 40 columns of the display, Columns 0 - 39.

Following is a list of commands that move the display window. The keyboard commands are direct commands which are not transmitted to the ATR8000. The other commands must be transmitted from the ATR8000.

Moving the Display Window:

From the Keyboard

1)	CTRL BACK S	This toggle command switches the display window to show either the first 40 columns or the last 40 columns of the 80 column display. For example, if the first 40 columns show on the screen (Columns 0 - 39), entering CTRL BACK S changes the display to show the last 40 columns (Columns 40 - 79). [A HOME code also moves the window to show Columns 0 - 39.]
2)	CTRL ;	Moves the display window one column to the right. (The window will not move if this command is entered and the last 40 columns are currently displayed on the screen {Columns 40 - 79}.)
	CTRL .	Moves the display window one column to the left. (The window will not move if this command is entered and the first 40 columns are currently displayed on the screen {Columns 0 - 39}.)
3)	CTRL 3	This toggle command turns the Auto Display mode on and off. When the Auto Display mode is active, the display window moves with the cursor. (The default is on.)

From the ATR8000

1)	ESC >	An ESC > sequence moves the display window one column to the right. (The window will not move if this command is received and the window currently shows the last 40 columns {Columns 40 - 79}.)
	ESC <	An ESC < sequence moves the display window one column to the left. (The window will not move if this command is received and the screen currently displays the first 40 columns {Columns 0 - 39}.)
2)	ESC Zn	An ESC Z sequence can be used to set the Auto Display mode to follow the cursor. For more information about ESC Z and the ESC Z variables, consult Section V.3.

II.2. Booting CP/M from a Terminal

Booting CP/M from a terminal is a simple process.

Step 1 Turn the power on the system.

Step 2 The drives' motors will run for about 3 seconds. When the motors shut off, insert the CP/M disk into Drive A.

Step 3 Press <RETURN>. ATRMON and # will show on the screen.

STEP 4 Type B<RETURN>. (B stands for "boot.") CP/M is now booted and its signon message shows on the screen (A>).

II.3. Backing Up the CP/M Disk

Before continuing, backup the CP/M disk. The programs used in this process are explained in detail later in this supplement.

Step 1 With the CP/M disk in Drive A, type DDINIT and press <RETURN>. This is a disk initializing program. DDINIT and its menu will show on the screen. Remove the CP/M disk from Drive A.

Step 2 Choose Format #4 (it puts the most space on a disk). Select A as the Drive ID. Insert a blank disk into Drive A. [5 1/4" disks must not have a write-protect tab on the disk notch. 8" disks need a foil write-protect tab over the notch in the disk.] Press Y to format.

Step 3 When the format is completed, remove the newly-formatted disk from Drive A and reinsert the CP/M disk. Enter <CTRL><C> to return to CP/M.

Step 4 Type DDSYSGEN and press <RETURN>. This is a double density system tracks copy program. Choose Function 1 and read the tracks off of the disk in Drive A. When the menu reappears, remove the CP/M disk from Drive A.

Step 5 Insert the newly-formatted disk into Drive A. Select Function 2 and write the system tracks onto this disk. When this is done, the double density CP/M disks have been copied to this disk.

Step 6 To move all the files from the master CP/M disk to the backup CP/M disk, put the master CP/M disk in Drive A and the backup copy in Drive B. Type: PIP B:=A:*.*[V]

NOTE: If you only have one drive, you will need to do the ONEDSK patch (listed in the DDSYSGEN section) before you can copy the files. ONEDSK will let you use one drive to copy between disks.

III. CP/M in Brief

This section briefly describes some of the functions and operations of CP/M. It is NOT a detailed account of either and should be used accordingly. The CP/M manual from Digital Research describes CP/M in detail.

III.1. Filenames

In CP/M filenames must fit a specific pattern. The name is divided into a filename, optionally followed by a period (.) and an extent. The filename can be up to eight digits, the extent up to three. [FILENAME.EXT] Extents are generally used to describe what type of file it is. For example, a text file might have .TXT or .DOC for the extent. Compiled CP/M programs use .COM for the extent, so do not use this for noncompiled programs. Other extents with specific meanings are .ASM, .MAC, .REL, .OVR and .LIB. Some sample names are:

MANUAL.TXT DISKMON.COM DOCUMENT DETAILS.DOC STAT.COM SYSTEM.SWP

In CP/M compiled programs run after the filename is entered. For example, PIP.COM runs after PIP<RETURN> is entered.

Ambiguous Filenames For some CP/M commands, filenames can be referred to either ambiguously or specifically. There are two special characters, * and ?, that are used to refer to ambiguous names. ? allows ambiguous reference to one digit, * allows ambiguous reference to all digits on one side of the period that separates the name and the extent.

Some examples:

If you had a disk with the following files on it: CHAPTER1.TXT, CHAPTER2.TXT and CHAPTER3.TXT, all can be referenced by CHAPTER?.TXT. If you had a disk with various files on it and wanted to see a directory listing of only the CHAPTER files, the command: DIR CHAPTER?.TXT would list them.

If you had a disk with the files: DDCOPY.COM, DDSYSGEN.COM, and DDINIT.COM, all can be referenced by DD*.COM or DD??????.COM.

The ambiguous file references can be used with the STAT program to provide specific statistics for each file on a disk. This command is STAT *.*

III.2. Built-in Commands

CP/M has five built-in commands. These commands and a brief description of their uses follow.

Command	Function
ERA	Erases specified files.
DIR	Lists file names in a directory. The type of directory, such as only .COM files, can be specified.

REN	Renames a specific file. This follows the pattern of NEWNAME.EXT=OLDNAME.EXT.
SAVE	Saves memory contents in a file. The amount of memory to be saved must be specified.
TYPE	Types the contents of a file on the display. If TYPE is entered after a <CTRL><P>, then the contents will be displayed on the screen and printed on the printer (if on-line) at the same time.

III.3. CP/M Programs on the ATR8000 CP/M Disk

To see a display of the CP/M programs on the ATR8000 disk, first boot CP/M, then do a directory of the disk. [From the CP/M prompt A>, type "DIR<RETURN>".] Your disk should have the following programs (they may be in a different order):

```
A: MODEM    DOC : DDINIT   COM : MODEM    COM : DDSYSGEN COM
A: DISKMON  COM : ASM      COM : BIOS     COM : CBIOS    ASM
A: DDT      COM : DEBLOCK  ASM : DISKDEF  LIB : DUMP     ASM
A: DUMP     COM : ED       COM : LOAD     COM : PIP      COM
A: STAT     COM : SUBMIT   COM : SYSGEN   COM : XSUB     COM
A: DISKDEF  COM : MOVCPM   COM : SYSTEM   SWP
```

Some of these programs are from Digital Research and some are from SWP. The Digital Research CP/M programs are explained in their CP/M manual. Two of the Digital Research programs are used extensively in disk operations; these are PIP.COM and STAT.COM.

III.3.A. PIP.COM

PIP.COM is a command file. It is executed by entering PIP followed by a command string. PIP equations follow the format:

```
destination drive:destination filename = source drive:source filename
```

A valid example is: `A>PIP A:STAT.COM=B:STAT.COM` [This copies STAT.COM from Drive B to Drive A.]

If the destination filename is the same as the source filename (i.e. you don't want to rename it), then it is not necessary to list the destination filename.

Following this guideline, the above example could also be:

`A>PIP A:=B:STAT.COM` [This also copies STAT.COM from Drive B to Drive A.]

Verifying The PIP equation can be followed by [V]. This verifies the copy process. It is a good idea to always verify. For example, the above equation with the verify option would be: `A>PIP A:=B:STAT.COM[V]`

Ambiguous Filenames As with many CP/M progrgams, PIP accepts ambiguous filenames. If you want to copy all files from Drive B to Drive A, you could type: A>PIP A:=B:*.*[V]

To copy all the command files from Drive B to Drive A, you could type: A>PIP A:=B:*.COM[V]. More on ambiguous filenames and other PIP possibilities are in the Digital Research CP/M manual.

III.3.B. STAT.COM

STAT.COM is a command file. One of its uses is to determine disk statistics. The following will describe some of STAT's uses in this context. For other STAT information, consult the Digital Research CP/M manual.

STAT is used to determine how much storage space is left on a disk. Entering: A>STAT will tell you how much space is left on Drive A. The remaining space on Drive B will be shown if you enter: A>STAT B:

File Size To get specific information about the size of particular files, STAT can be followed by a filename, specific or ambiguous. Some examples:

STAT CHAPTER?.TXT will list statistics on all files CHAPTER?.TXT. The statistics will take the form:

```
RECS   BYTES   EXT  ACC  DRIVE:FILENAME.EXT
```

At the end of the listing, the remaining number of available bytes is listed.

STAT *.* will list statistics on all files on a disk.

If you are not sure that you have room for a file on a particular disk, use STAT to gauge the file's size and also use it on the disk you want to copy the file to.

Disk Characteristics Statistics on a disk can be obtained by the STAT command: STAT DSK: (STAT B:DSK: for Drive B). Among the printout will be ___: Kilobyte Drive Capacity. This tells you the total storage space of a disk. By looking at this number, you can determine if a disk is single or double density. For example: a single density 8" disk has a capacity of 256k and a double density disk formatted with the 1024 byte format has a capacity of 674k.

III.4. SWP ATR8000 CP/M Programs

The SWP CP/M files on your disk are:

DDINIT.COM	for formatting and verifying single and double density disks.
DDSYSGEN.COM	for reading, writing and customizing double density system tracks. (Use SYSGEN.COM for reading and writing single density system tracks.)
DISKMON.COM	allows primitive disk access for analyzing and editing.

MODEM.COM	a multifunction modem program for modems connected to the RS-232 Port.
MODEM.DOC	a document file containing instructions for MODEM.COM
SYSTEM.SWP	this file is used by DDSYSGEN in the customizing of system tracks.
DISKDEF.COM	a program that sets Drive B to have the characteristics of other computers. This allows various single and double density CP/M disk formats to be used with the ATR8000.

These programs are thoroughly explained in Section IV.

III.5. CP/M Disk Formats That Don't Need DISKDEF.COM

The ATR8000 is able to read various single and double density CP/M disk formats. Some of these formats can be run on the ATR8000 as is; they don't require any type of a setup program (such as DISKDEF.COM). These disks are:

8" — All IBM standard single density, single-sided CP/M disks

5 1/4" — Single density, single-sided Xerox 820 disks
Single density, single-sided Cromemco disks

The above disks can be used in two ways:

#1 With no modification they can be run from Drive B, C or D, or

#2 They can be DDSYSGENed with ATR8000 CP/M and then run in Drive A. [To do this: run DDSYSGEN, use #1 to read the double density CP/M tracks off of an ATR8000 CP/M disk into memory, use #2 to write these tracks from memory onto the disk. #2 of DDSYSGEN automatically double density formats the system tracks of a disk before writing to it.]

DISKDEF.COM, discussed in Section IV, allows other disk formats to work with the ATR8000.

III.6. Using Different Densities in Different Drives

The ATR8000 is able to run both single and double density disks. Your ATR8000 CP/M disk is double density. Single density disks can be run in Drive B, C or D. Programs can be copied from single density disks to double density disks using PIP.

You'll want to run most of your programs on double density disks because double density operation is much faster than single density operation. If you purchase programs on single density disks, simply PIP the files to double density disks.

IV. SWP CP/M Utility Programs for the ATR8000

This section describes the SWP CP/M utility programs for the ATR8000. These programs have user-oriented displays and prompts that simply explain options and directions. You may find it useful to run each program while reading the following information.

IV.1. DDINIT.COM — Disk Initializing

When DDINIT is run, a signon message will appear on the screen. It will instruct you to remove all valuable disks before continuing. This is to prevent the accidental reformatting (and, therefore, erasing) of any good disks. DDINIT will remain in the computer's memory until you exit the program.

After all disks are removed (you can simply open the drives' doors), press <RETURN>. After doing so a menu of format selections shows on the screen:

```
            — Disk Format Menu —

        density          sector size
     1) single            128 bytes
     2) double            256 bytes
     3) double            512 bytes
     4) double           1024 bytes

        enter number of format (1 to 4) ...__
```

Choose a format and press <RETURN>. The next prompt instructs you to enter a drive ID (A,B,C, or D). This is the drive that is to be used to format the disk. Enter a drive ID and press <RETURN>. Insert the disk to be formatted in the drive. 8" disks must have a foil tab placed over the write-protect notch in the disk. 5 1/4" disks cannot have a tab on them.

After this selection is entered, the prompts say to press <Y> to format or to press <CTL-C> to exit to CP/M. If you have removed the system disk from Drive A, it must be reinserted to exit to CP/M. If it is not, the computer will have to be rebooted.

If, after entering the format and drive ID, you decide that you want to change the selection, simply press <RETURN> instead of <Y> or <CTRL><C>. This will return you to the DDINIT menu.

As the disk is being formatted, the screen will show the track currently being done. The program formats and then verifies each track before going on to the next.

If any error messages occur during the format, DO NOT use that disk unless you reDDINIT it and it passes with no errors. If there are any bad sectors on a disk, the error message will look like the following:

```
TRACK 39 *** 1 bad sector(s) ***
```

When the format is complete, if any bad sectors occurred, a message like the following will appear:

```
done ... 1 bad sectors detected
```

If the drive door on the drive to be used in formatting is open, if the disk is inserted into the drive incorrectly, or if the specified drive is not connected to the system, the following error message will appear:

```
*** DRIVE NOT READY ***
(drive door open? disk in wrong?)
```

Here you have three options:

1) Correct the problem and press <Y> to format,
2) Press <CTRL><C> to exit to CP/M (if a system disk is in Drive A), or
3) Press <RETURN> to choose another set of format selections.

IV.2. DDSYSGEN.COM — Reading, Writing and Generating CP/M System Tracks

DDSYSGEN is a program for reading, writing and customizing double density CP/M system tracks. The system tracks are the first two tracks of the disk. When these tracks have the CP/M system written onto them, the disk is able to boot the computer. All disks that will be used in Drive A must have system tracks on them. Disks used in other drives can have system tracks on them, but they don't have to have them.

Run DDSYSGEN. The following menu will appear on the screen:

```
... system generator for ATR8000 ...

        functions available:

      1) Read system tracks from disk.
      2) Write system tracks to disk.
      3) Generate customized CP/M.

enter number of function (1,2, or 3)
or press <CTL-C> to exit to CP/M ...
```

After the DDSYSGEN menu appears, the disk it was run from can be removed from the computer. DDSYSGEN will remain in memory until the command to exit to CP/M is executed. (Before exiting make sure that a system disk is in Drive A.)

1) Read system tracks from disk:

This function reads existing double density system tracks from a disk into memory. This is the first step in copying system tracks from one disk to another and in reading tracks to alter them. When you select <1> and press <RETURN> the screen will show:

```
                    ---- Read System Tracks ----
               enter drive name (A,B,C, or D) ...

                    press <RETURN> when ready
                    or <CTL-C> to abort ...
```

ter a drive name, insert the disk whose tracks are to be read into the drive
d press <RETURN>. In a few seconds, "function complete" will show on the
'een and then the menu will reappear.

the tracks being read are errored, the message "DISK I/O ERROR" will flash
the screen before "function complete."

rite system tracks to disk.

function writes double density system tracks from memory onto a specified
It is used after #1 and #3. Before DDSYSGEN writes the tracks onto the
it reinitializes the system tracks of the disk.

h Option 1, the write option asks for the drive to be used. Enter the
name, insert the disk, and press <RETURN>. In a few seconds "function
e" will show, then the menu will show on the screen.

e is an error in this procedure, "DISK I/O ERROR IN SYSTEMS AREA" will
ı the screen. Make sure that 8" disks have a write-protect tab on them
t 5 1/4" disks do not.

system tracks written onto a disk, cold boot the computer with that

tem tracks are in memory, Option 2 can be used repeatedly. For
if you are making a pile of new system disks, read the system tracks
y with #1, then use #2 until all disks have been written to.

e customized CP/M

n is used to customize CP/M to precisely match your system. The
stem allows the connection of a wide variety of peripherals. The
set of peripherals is the SWP standard:

le-sided, 40 track 5 1/4" drives.
le-sided, 77 track 8" drives.
head settling time.
p rate that automatically adjusts to the fastest rate the drive
pable of running. (This rate can be marginal for some drives, so
ymbolic patch function allows the user to set a defined rate.)
ms head load delay.
e block size for 5 1/4" disks.
llel printer.
communications port configured for 1200 baud/odd parity/7
ull duplex.

```
          -- Read System Tracks --
   enter drive name (A,B,C, or D) ...

        press <RETURN> when ready
        or <CTL-C> to abort ...
```

Enter a drive name, insert the disk whose tracks are to be read into the drive and press <RETURN>. In a few seconds, "function complete" will show on the screen and then the menu will reappear.

If the tracks being read are errored, the message "DISK I/O ERROR" will flash on the screen before "function complete."

2) Write system tracks to disk.

This function writes double density system tracks from memory onto a specified disk. It is used after #1 and #3. Before DDSYSGEN writes the tracks onto the disk, it reinitializes the system tracks of the disk.

As with Option 1, the write option asks for the drive to be used. Enter the drive name, insert the disk, and press <RETURN>. In a few seconds "function complete" will show, then the menu will show on the screen.

If there is an error in this procedure, "DISK I/O ERROR IN SYSTEMS AREA" will flash on the screen. Make sure that 8" disks have a write-protect tab on them and that 5 1/4" disks do not.

To test system tracks written onto a disk, cold boot the computer with that disk.

Once system tracks are in memory, Option 2 can be used repeatedly. For example, if you are making a pile of new system disks, read the system tracks into memory with #1, then use #2 until all disks have been written to.

3) Generate customized CP/M

This option is used to customize CP/M to precisely match your system. The ATR8000 system allows the connection of a wide variety of peripherals. The following set of peripherals is the SWP standard:

- single-sided, 40 track 5 1/4" drives.
- single-sided, 77 track 8" drives.
- 16 ms head settling time.
- a step rate that automatically adjusts to the fastest rate the drive is capable of running. (This rate can be marginal for some drives, so the symbolic patch function allows the user to set a defined rate.)
- a 50 ms head load delay.
- 1k byte block size for 5 1/4" disks.
- a parallel printer.
- RS-232 communications port configured for 1200 baud/odd parity/7 bits/full duplex.

If you have other peripherals, or if your peripherals do not meet all of the above standards, the CP/M system tracks must be customized using this option of DDSYSGEN.

When you select <3> and press <RETURN>, the following shows on the screen:

```
--- Generate Custom system ---

insert disk with SYSTEM.SWP file
into drive A and press <RETURN> ...
```

SYSTEM.SWP comes on the ATR8000 CP/M disk. When <RETURN> is pressed, the system is read from this file into memory. The screen will show "reading system" followed by a string of "+"s. If SYSTEM.SWP was not on the disk in Drive A when <RETURN> was pressed, the error message "CANNOT READ SYSTEM FILE" will show on the screen along with the message "press any key to return to main menu." Pressing any key will return the system to the DDSYSGEN menu.

When the system is read, the following message will show:

```
Do you wish to use the symbolic
patch function to change any
system parameters from their
default values? (y/n) ...
```

To customize the system tracks, enter <Y>. The screen will show:

```
param? ...
```

The parameters that can be changed are listed below. When a parameter is entered the screen will show the parameter and its current value, and it will ask for the change to value. This follows the format:

```
param? _______ = __  change to? __
```

When all desired parameters are entered, press <CTL-C> to return to the DDSYSGEN menu. Then use Option 2 to write the newly customized tracks onto a double density disk.

Making Changes:

Symbolic patch function data entries are entered in hexadecimal. Binary to hex, decimal to hex, and decimal to binary charts follow. Use these charts along with the instructions in each subsection to compute proper data entries for any changes made.

Binary	Hex
0000	0
0001	1
0010	2
0011	3
0100	4
0101	5
0110	6
0111	7
1000	8
1001	9
1010	A
1011	B
1100	C
1101	D
1110	E
1111	F

Binary	Decimal
00000	0
00001	1
00010	2
00011	3
00100	4
00101	5
00110	6
00111	7
01000	8
01001	9
01010	10
01011	11
01100	12
01101	13
01110	14
01111	15
10000	16
10001	17
10010	18
10011	19
10100	20
10101	21
10110	22
10111	23
11000	24
11001	25
11010	26
11011	27
11100	28
11101	29
11110	30
11111	31

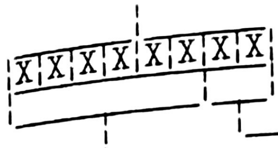
Dec.	Hex	Dec.	Hex	Dec.	Hex	Dec.	Hex	Dec.	Hex
0	0	55	37	110	6E	165	A5	220	DC
1	1	56	38	111	6F	166	A6	221	DD
2	2	57	39	112	70	167	A7	222	DE
3	3	58	3A	113	71	168	A8	223	DF
4	4	59	3B	114	72	169	A9	224	E0
5	5	60	3C	115	73	170	AA	225	E1
6	6	61	3D	116	74	171	AB	226	E2
7	7	62	3E	117	75	172	AC	227	E3
8	8	63	3F	118	76	173	AD	228	E4
9	9	64	40	119	77	174	AE	229	E5
10	A	65	41	120	78	175	AF	230	E6
11	B	66	42	121	79	176	B0	231	E7
12	C	67	43	122	7A	177	B1	232	E8
13	D	68	44	123	7B	178	B2	233	E9
14	E	69	45	124	7C	179	B3	234	EA
15	F	70	46	125	7D	180	B4	235	EB
16	10	71	47	126	7E	181	B5	236	EC
17	11	72	48	127	7F	182	B6	237	ED
18	12	73	49	128	80	183	B7	238	EE
19	13	74	4A	129	81	184	B8	239	EF
20	14	75	4B	130	82	185	B9	240	F0
21	15	76	4C	131	83	186	BA	241	F1
22	16	77	4D	132	84	187	BB	242	F2
23	17	78	4E	133	85	188	BC	243	F3
24	18	79	4F	134	86	189	BD	244	F4
25	19	80	50	135	87	190	BE	245	F5
26	1A	81	51	136	88	191	BF	246	F6
27	1B	82	52	137	89	192	C0	247	F7
28	1C	83	53	138	8A	193	C1	248	F8
29	1D	84	54	139	8B	194	C2	249	F9
30	1E	85	55	140	8C	195	C3	250	FA
31	1F	86	56	141	8D	196	C4	251	FB
32	20	87	57	142	8E	197	C5	252	FC
33	21	88	58	143	8F	198	C6	253	FD
34	22	89	59	144	90	199	C7	254	FE
35	23	90	5A	145	91	200	C8	255	FF
36	24	91	5B	146	92	201	C9		
37	25	92	5C	147	93	202	CA		
38	26	93	5D	148	94	203	CB		
39	27	94	5E	149	95	204	CC		
40	28	95	5F	150	96	205	CD		
41	29	96	60	151	97	206	CE		
42	2A	97	61	152	98	207	CF		
43	2B	98	62	153	99	208	D0		
44	2C	99	63	154	9A	209	D1		
45	2D	100	64	155	9B	210	D2		
46	2E	101	65	156	9C	211	D3		
47	2F	102	66	157	9D	212	D4		
48	30	103	67	158	9E	213	D5		
49	31	104	68	159	9F	214	D6		
50	32	105	69	160	A0	215	D7		
51	33	106	6A	161	A1	216	D8		
52	34	107	6B	162	A2	217	D9		
53	35	108	6C	163	A3	218	DA		
54	36	109	6D	164	A4	219	DB		

Head Settling Time and Step Rate

Locations: RATEA, RATEB, RATEC, RATED

Each of these locations is for one of the four possible CP/M drives: Drive A, Drive B, Drive C, and Drive D. The industry standard head settling time is 16 ms (milliseconds). [This is the default value.] The ATR8000 automatically adjusts the step rate of each drive to the fastest rate the drive will run. It is possible that this rate will be marginal, i.e., the drive may have occasional problems running at this speed. These locations allow you to select a determined rate for each of the four possible drives.

Values for settling time and step rate are entered into a binary chart (depicting 8 bits or one byte) and then translated into hex. A binary number is four digits long, therefore, the byte is divided into two 4 bit sections. Each of these sections contains a binary number which is translated into hex. Then these two hex numbers make up the final value.

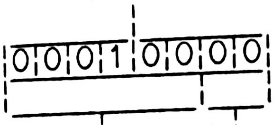


These two bits determine the step rate. The possible values for 5 1/4" and 8" drives:

Value	5" time	8" time
00	6 ms	3 ms
01	12 ms	6 ms
10	20 ms	10 ms
11	30 ms	19 ms

These 6 bits determine the head settling time. The default is 16 ms (the industry standard). The desired settling time is divided by four, then this product is entered, in binary, into these six bits (beginning in the rightmost bit). Any extra bits are filled with 0s.

For example: The following shows this location with a 16 ms head settling time and a step rate of 3 ms for an 8" drive.



00 is 3 ms for an 8" drive as shown above.

16 ms is the desired rate. 16 divided by 4 is 4 in decimal. This decimal 4 must be converted to binary. The binary value for 4 decimal is 0100 (as shown in the decimal to binary chart), so 0100 is entered into the rightmost bits, and the remaining two bits are filled with 0s.

Now the bit chart is complete. The first four bits are 0001 binary, or 1 hex. The last four bits are 0000, or 0 hex. Therefore, the value to enter at location RATEA to set Drive A to have a head settling time of 16 ms and a step rate of 3 ms, is 10. [Notice that you do NOT add the digits together (i.e., 1+0=1), rather the left four bits make up the left digit, 1, and the right four bits make up the right digit, 0.]

If you change any of these locations, be sure that RATEA is changed for Drive A, RATEB for Drive B, and so on.

Head Load Delay

Location: HDLDTM

Head load delay is the amount of time between selecting a new drive and doing any reads or writes to the new drive. The value is determined in decimal, then converted to hex. The default is 50 ms, or 32 hex. Possible decimal values are from 1 to 255 ms.

Multiple or Single Drive System

Location: ONEDSK

The value at this location determines if the system is a single drive or a multiple drive system. The default is for multiple drives. Single drive system users need to change this value.

* Users with one drive systems can refer to Drive A as A, B, C or D when ONEDSK is set to 1. This allows the drive to run nonsysgened disks and allows one drive to copy disks. For example, with this set to 1, you can use PIP to make a copy of a disk by referring to the drive as both A and B. The computer will instruct you when to swap disks during the procedure. With this set to 1, you can run a nonsysgened disk in the drive by referring to the drive as B, C or D, rather than A.

Value	Meaning
0	Multiple drives
1	Single drive

Type of Drives

Locations: NTRKSA, NTRKSB
NTRKSC, NTRKSD

These locations correspond to Drive A, Drive B, Drive C and Drive D. If your system has drives other than single-sided 40 track 5 1/4" or 77 track 8", then customize the system to fit your drives. Enter the appropriate hex value for each drive using the following chart:

Value (hex)	Type of Drive
23	35 track, single-sided 5 1/4" drive
9F	+35 track, double-sided 5 1/4" drive
28	*40 track, single-sided 5 1/4" drive
A8	+40 track, double-sided 5 1/4" drive
50	+80 track, single-sided 5 1/4" drive
D0	+80 track, double-sided 5 1/4" drive
4D	*77 track, single-sided 8" drive
CD	77 track, double-sided 8" drive

* The ATR8000 is preconfigured to accept these types of drives, so it is not necessary to enter either of these values. (It can distinguish between 5 1/4" and 8" drives.)

+ These types of drives also require that location DD5IN (CP/M disk parameter block section) is changed.

For Users with Nonstandard Drives:

If your drive is not listed above, the value can be determined by the following process. The value can be determined in decimal, then entered in hex.

Single-sided drives: Determine the number of tracks the drive has. Then use the decimal to hex charts to convert this number to hex. For example, 40 decimal equals 28 hex. Enter this value for the location.

Double-sided drives: Determine the number of tracks the drive has. Now add 128 (decimal) to the track number. Convert this number to hex and enter it at the location.

For example: To compute the value for a 40 track, double-sided drive, add 40 and 128. 168 = A8 hex, the value to be entered.

CP/M Disk Parameter Blocks — Locations: DD8IN, DD5IN

The CP/M block size is preset to be 2k byte blocks for 8" disks and 1k byte blocks for 5 1/4" disks. WE DO NOT RECOMMEND CHANGING THE 8" BLOCK SIZE.

5 1/4" Users: CP/M only allows for 256 1k blocks of disk storage. Double-sided 5 1/4" drives and single-sided 80 track drives exceed this (remember this is double density CP/M — a double density, double-sided 40 track drive can have up to 390k bytes of storage). In order to realize all possible space, the block size needs to be changed to 2k blocks.

If any double-sided 5 1/4" drives or any 80 track drives are connected, make the following location changes:

Location	Default	Enter
*DD5IN+4	03	04
DD5IN+5	07	0F
DD5IN+9	3F	7F
DD5IN+13	10	20

* To access the location +n, first enter the location (DD5IN), then press <RETURN> until the proper n value is accessed.

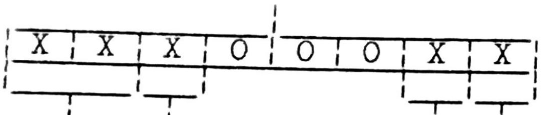
RS-232 Port Configuration — Locations: IBAUD, IBAUD+1

The RS-232 Port is preconfigured to be 1200 baud, odd parity, 7 bits and full duplex. These parameters must match the parameters of the peripheral interfaced to the RS-232 Port (and J12 must be properly configured).

If a serial printer is interfaced to the RS-232 Port, these locations must be properly set along with IIOBYT. Values for some printers are at the end of this section. If the baud rate in IBAUD is changed, IBAUD+1 must also be changed.

IBAUD:

This location's value is determined by computing the values in a byte (8 bits). The numbers are entered in binary, then converted to hex. These bits determine mode, scale, parity, and word length (automatically determined by parity selection). Use the following chart:



This bit is related to the next bit. When parity is selected, this bit determines whether it is odd or even.

Value	Parity
0	Even
1	Odd

This bit selects parity or no parity. (The type of parity is determined in the bit described above.) This selection also selects word length.

Value	Selection
0	No parity, 8 bits
1	Parity, 7 bits

This bit is for the scale of the baud rate.

Value	Meaning
0	> 1200 baud
1	<= 1200 baud

These two bits determine if a XONXOFF printer (half duplex) or if a full duplex communications port (or serial Epson printer) is selected.

Value	Selection
00	....
01	XONXOFF printer (half duplex)
10	Full duplex communications port (or serial Epson)
11	....

If selections are made to run a serial printer, location IIOBYT must also be considered.

IBAUD+1:

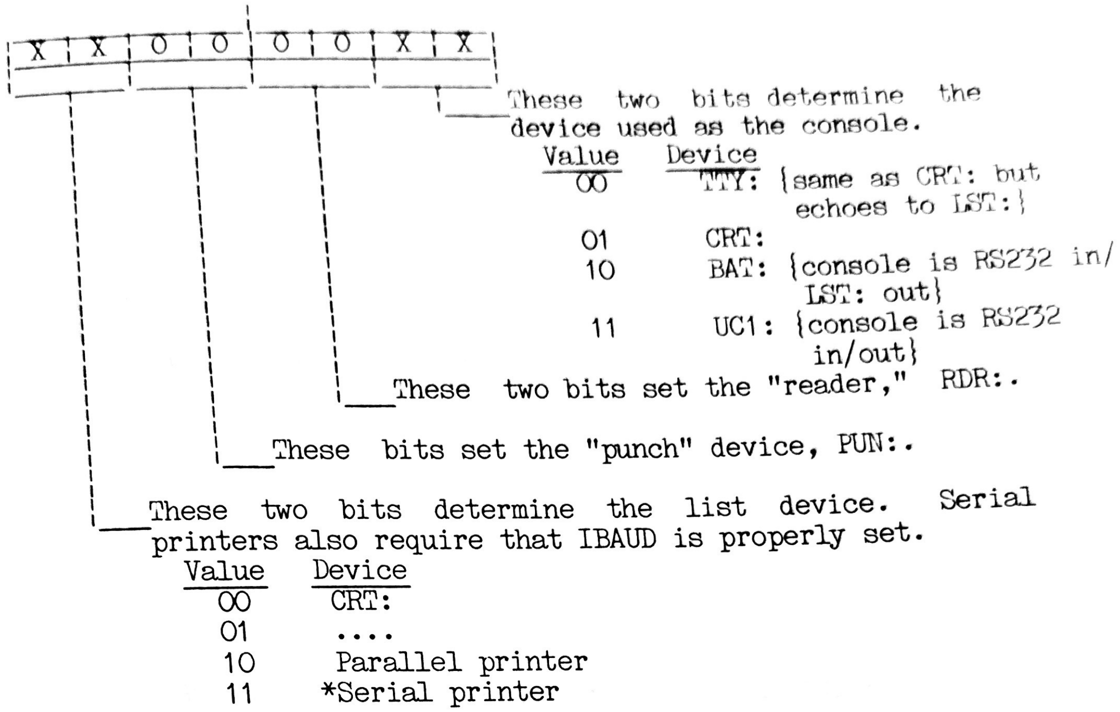
This location is accessed by pressing <RETURN> after IBAUD. The specific baud rate is set here. The selections here are related to the scale selection in IBAUD.

Value	Baud Rate if Scale = 0	Baud Rate if Scale = 1
0D	....	1200
1A	9600	600
34	4800	300
68	2400	150
8E	....	110
D0	....	75

Defining Character Oriented I/O Devices

Location: IIOBYT

The IIOBYT is computed by determining the values in a byte. The values are entered in binary, then converted to hex. The byte consists of four 2-bit sections, one section for each in/out character oriented device.



These two bits determine the device used as the console.

Value	Device
00	TTY: {same as CRT: but echoes to LST:}
01	CRT:
10	BAT: {console is RS232 in/ LST: out}
11	UC1: {console is RS232 in/out}

These two bits set the "reader," RDR:.

These bits set the "punch" device, PUN:.

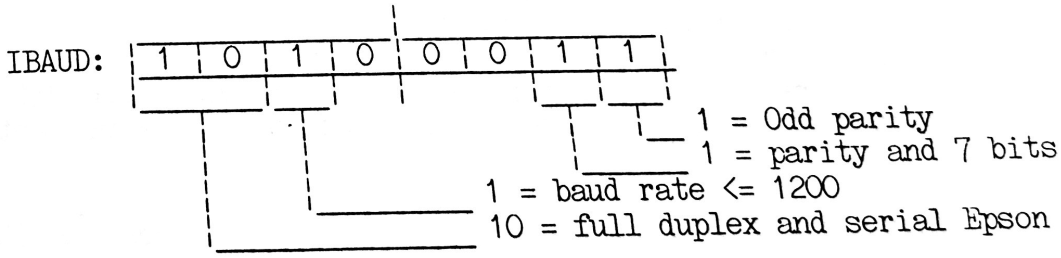
These two bits determine the list device. Serial printers also require that IBAUD is properly set.

Value	Device
00	CRT:
01	....
10	Parallel printer
11	*Serial printer

* Dtrline printers (serial) require full duplex set in IBAUD. Epson serial printers require full duplex set in IBAUD. XONXOFF printers (serial) require half duplex set in IBAUD. [IIOBYT is the only location set for parallel printers.]

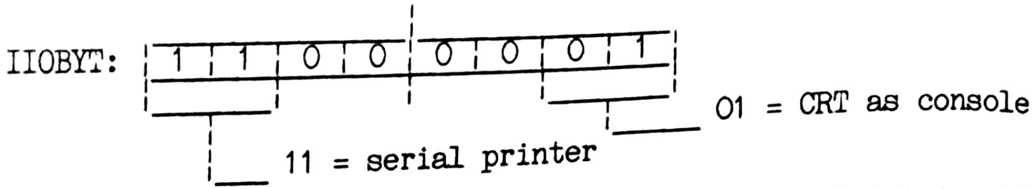
Setting IBAUD, IBAUD+1 and IIOBYT for some Serial Printers

For a serial Epson and dtrline printers at 1200 baud, odd parity and 7 bits:



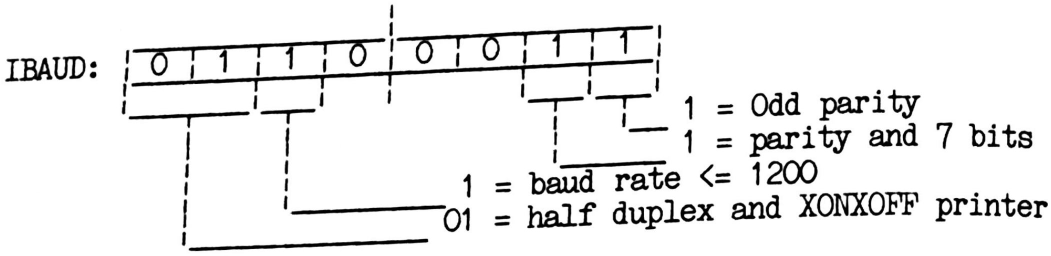
The rightmost bit is 1010. Using the binary to hex chart, this is A. The leftmost bit is 0011. Using the chart, this is 3. So the value for IBAUD is A3.

IBAUD+1: The value for 1200 baud is 0D.


IIOBYT:
1 1 1 0 0 0 0 0 1
01 = CRT as console
11 = serial printer

The rightmost bit is 1100, or C (hex). The leftmost bit is 0001, or 1 (hex). The value is C1.

For XONXOFF serial printers (like some Diablos) at 1200 baud, odd parity and 7 bits:


IBAUD:
0 1 1 0 0 0 1 1
1 = Odd parity
1 = parity and 7 bits
1 = baud rate <= 1200
01 = half duplex and XONXOFF printer

The value is 63.

IBAUD+1: OD.

IIOBYT: C1.

IV.3. DISKMON.COM — Gaining Primitive Disk Access

DISKMON is a multifunction program that gives primitive access to a disk. Among its uses is the ability to determine if a disk has bad sectors, tracks or blocks. Its options are:

READ This option can be used to read a file, or to read data by track, sector or block number. It is not necessary to type "READ," "R" also works. Possible commands are:

R filename.ext
RBn (B for block, n for number)
RTn (T for track, n for number)
RTnSn (T for track, s for sector, n for number)
R reads next sector after one of the above commands. Sectors are accessed in numerical order, i.e. Sector 2 follows Sector 1.

EDIT Allows editing of files, tracks, blocks and sectors. EDIT's commands:

EDIT filename.ext
EDIT Bn
EDIT Tn
EDIT TnSn

When editing anything larger than a sector, <RETURN> accesses the next sector. When all sectors have been accessed, X will show after <RETURN> is pressed. To halt a display, type <CTRL><S>; to restart the display type another <CTRL><S>. A halted display may be aborted by pressing <RETURN>.

Command keys in the EDIT mode:

<ESC> turns the insert on and off. Keep the insert off until the cursor is positioned in the location you wish to edit.

When the insert is off, the following keys move the cursor position:

For ATARI & Terminals	For the ATARI	For some Terminals	Action
<CTRL><H>	left arrow	SHIFT left arrow	Moves cursor left
<CTRL><L>	right arrow	SHIFT right arrow	Moves cursor right
<CTRL><K>	up arrow	SHIFT up arrow	Moves cursor up
<CTRL><J>	down arrow	SHIFT down arrow	Moves cursor down
CAPITAL M			Toggles the insert between ASCII/HEX
		BACKSPACE	Moves cursor left
		LINE FEED	Moves cursor down

If any changes are made during the EDIT mode, DISKMON will ask if you want the changes written to the disk. Enter <Y> for yes, <N> for no.

ALLOC Allocate shows used blocks on a disk. It will also show where a particular file resides on a disk. Entering ALLOC will display a chart like this:

```
  BLOCK #
   0....49 DD++++++++ ++++++++++ ++++++++++ ++++++++++ ++++++++++
  50....99 ++++++++++ +++++++++: :::::::::: :::::::::: ::::::::::
 100...149 :::::::::: :::::::::: :::::::::: :::::::::: ::::::::::
 150...199 :::::::::: :::::::::: :::::::::: :::::::::: ::::::::::
 200...242 :::::::::: :::::::::: :::::::::: :::::::::: ::
```

+ indicates used block   : indicates unused block

To find the location of a particular file on a disk, enter: ALLOC filename.ext<RETURN>. A block map similar to the one above will be displayed with +s representing the location of the file.

MAP MAP verifies a disk and shows either a track or a block map. To get a block map, enter MAP B. :s indicate good blocks
+s indicate errored blocks.

To get a track map, enter MAP T. :s indicate good sectors
+s indicate errored sectors

The track map is longer than the 24 rows of the display screen. The map can be halted by pressing a <CTRL><S>. Another <CTRL><S> will restart the display, a <RETURN> will abort it.

BACKUPsd	This command can be used to make backup files (we recommend using PIP for this). S is the source drive, d the destination drive. This will backup disks using one drive. [One drive users should set ONEDSK in DDSYSGEN #3 and use PIP for copying.] The backup can be verified by adding a [V] at the end of the command.
SELn	Allows selection of the drive to be used in DISKMON. N is the drive number. If you change disks in a drive, you need to log off of the drive, then back on, using SEL.
DIR	Displays the file directory of the logged drive.
BYE	Exits DISKMON and returns to CP/M.

IV.4. MODEM.COM — running a Modem From the RS-232 Port

MODEM is a version of SMODEM37 (a CP/M user's group program) that has been specifically rewritten for the ATR8000. It has an extensive multifunction menu. Directions and explanations for this program are on the ATR8000 CP/M disk in the file MODEM.DOC. To read this file, use the built-in TYPE command of CP/M. [TYPE MODEM.DOC<RETURN>. <CTRL><S> will halt and restart the display. To print the file on your printer, type a <CTRL><P> before pressing <RETURN>.]

IV.5. DISKDEF.COM — Compatibility with CP/M Disks from Other Computers

DISKDEF is a setup program that enables the ATR8000 to read from, write to and run disks from other CP/M computers. DISKDEF has an extensive menu of single-sided single and double density disk formats. After making a selection, DISKDEF asks for the name of the drive that will contain the nonATR8000 CP/M disk. After it is run, that particular drive is "setup" to have the necessary CP/M characteristics to run programs from the nonATR8000 disk, to read it and to write to it. To write to disks for other computers that do not use one of the formats in DDINIT, simply format the disks needed in the other computer before using them in the ATR8000.

Some of DISKDEF's format selections are:

For 5 1/4" disks:

Osborne I (SD)

Kaypro II (DD)
TRS-80 MOD I (Omikron, SD)
Heathkit H89 (Magnolia, DD)
IBM-PC (CP/M-86)

Osborne II (DD)
NEC PC-8001A (DD)
Xerox 820-II (DD)
Morrow Micro Decision (DD)
Zenith Z-100 (DD)
DEC Robin (DD)

Generic 256 x 16
Generic 256 x 18
Generic 512 x 9
Generic 512 x 10
Generic 1024 x 5

For 8" disks:

Generic 256 x 26
Generic 512 x 16

Generic 512 x 15
Generic 1024 x 8

Generic 1024 x 9

* Generic formats describe bytes and sectors. All generic formats are options in SWP's Dual Density upgrades for the Xerox 820 and the Bigboard.

When DISKDEF is run, a menu of disk formats, including the above selections, appears. Each format has a number. The screen tells you to:

```
enter number of desired disk type or press
<CR> to view next screen or ^C to exit ...

? _
```

Type a selection and <RETURN>. The next question asks for the name of the drive that is to be set up to read the disk. Put a disk of the selected format into the drive of your choice (do not use A unless ONEDSK is set for a single drive system). Then enter the name of the drive and press <RETURN>.

If the disk is not in the selected drive, if it is in the drive improperly, or if it is not the same as the chosen format, an error message will appear:

```
BIOS error on _: not ready?
```

Correct the error and press <RETURN>. The screen will display the format selection and the drive that is set for that format. For example:

B: set to OSBORNE I format

Then the CP/M prompt will show. Once a drive is set to another computer's format, the chosen computer's disks used in that drive can be read from, written to or programs can be run. If writing to such disks, the disks will have to be preformatted using the other computer's format program.

Terminals and Inverse Video

Some programs, like OSBORNE programs, use inverse video in their displays. The ATARI properly displays this. ATR8000-Terminal users may have to set their terminal to be able to display inverse video (otherwise the inverse portion of the display will be very light). The command for an Adds Viewpoint terminal to use inverse video is <ESC><O><P>. For other terminals, consult the terminal's manual.

V. Technical Information

This section contains technical information concerning CP/M and the ATR8000. This information is mainly for reference.

V.1. Interpreting CP/M Error Messages: the Status Register

The Status Register monitors various conditions in the floppy disk controller (part of the circuitry of the ATR8000's board). This register is made up of 8 bits, with each individual status bit having its own meaning.

When a CP/M error message appears on the screen, it may be followed by a number. This number refers to one or more of the status bits. [Although some of the status bits point out errors, not all do. Some simply tell which conditions in the floppy disk controller are active.] The Status Register chart below shows the individual bits (Bits 0 - 7). The decimal equivalent of each bit is also referenced because the SWP BIOS uses decimal output for error messages.

To use the following chart, first determine the type of command that was active when the error message occurred (whether the floppy disk controller was trying to seek, read, or write). Then cross reference this command with the decimal number that appeared in the error message.

For example, ERROR 64, when the system was trying to write to a disk, means that there is a write protect error. This means that you were attempting to write to a disk that was write protected (for example, if an 8" disk is involved, you need to place a write-protect tab on it, a 5 1/4" disk needs the tab removed).

If a number in an error message is not one of the 8 decimal numbers above (1, 2, 4, 8, 16, 32, 64, or 128), then it is a combination of two. For example, ERROR 24 means that there is a problem with Bit 4 (16 decimal) and with Bit 3 (8 decimal). More detailed explanation of the bit meanings follow the chart.

Chart 1: A Summary of the Status Register

COMMAND ⇩	STATUS BITS							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	Decimal 128	Decimal 64	Decimal 32	Decimal 16	Decimal 8	Decimal 4	Decimal 2	Decimal 1
Seek	NOT READY	WRITE PROTECT	HEAD LOADED	SEEK ERROR	CRC ERROR	TRACK 0	INDEX	BUSY
Read	NOT READY	-	RECORD TYPE	RECORD NOT FOUND	CRC ERROR	LOST DATA	DATA REQUEST	BUSY
Write	NOT READY	WRITE PROTECT	WRITE FAULT	RECORD NOT FOUND	CRC ERROR	LOST DATA	DATA REQUEST	BUSY

NOT READY indicates that the requested drive is not ready. It can occur if the drive door is not closed, or if you inadvertently try to access a drive that doesn't exist.

WRITE PROTECT means that the write protect feature is active and the disk cannot be written to. To write to an 8" disk, you must place a foil write-protect tab on the disk. To write to a 5 1/4" disk, you must remove the write-protect tab from the disk.

HEAD LOADED means that the drive head is loaded and engaged.

RECORD TYPE. When a record is being read, this indicates the record-type code from the data field address mark. 1= deleted data mark. 0= normal data mark.

WRITE FAULT indicates that there is a fault in writing.

SEEK ERROR means that the desired track was not verified.

RECORD NOT FOUND means that the desired track, sector, or side was not found.

CRC ERROR means that there was a checksum error in data in a sector. If this occurs with a RECORD NOT FOUND or a SEEK error (decimal 24), then there is an error in one or more ID fields. If it occurs alone, it indicates error in a data field.

TRACK 0 indicates that the drive's Read/Write head is positioned to Track 0.

LOST DATA occurs when the computer did not respond to a data request in one byte time. This happens when you try to read a longer sector than the active program was expecting.

INDEX means that the index mark is detected from the drive.

DATA REQUEST is a copy of the data request output. It indicates that the data request is full on a read operation, or that the data request is empty on a write operation.

BUSY means that a command is under execution.

V.2. Keyboard Codes

The keyboard codes consist of two coordinates, X,Y, that represent a unique 8-bit code for each character. X represents the four most significant bits of the code; Y represents the four least signicant bits.

As marked, some of the codes are produced by more than one key. These are:

Code (HEX)	1st key	2nd key	3rd key
08	CTRL +	CTRL H	
09	TAB	SHIFT TAB	CTRL I
0A	CTRL =	CTRL J	
0B	CTRL -	CTRL K	
0C	CTRL *	CTRL L	
0D	RETURN	CTRL M	

Chart 2: Keyboard Codes

X (MS) Y (LS)		000	001	010	011	100	101	110	111	ASCII
		0	1	2	3	4	5	6	7	HEX
0000	0	CTRL ,	CTRL P	space	0	@	P	☒	p	
0001	1	CTRL A	CTRL Q	!	1	A	Q	a	q	
0010	2	CTRL B	CTRL R	"	2	B	R	b	r	
0011	3	CTRL C	CTRL S	#	3	C	S	c	s	
0100	4	CTRL D	CTRL T	$	4	D	T	d	t	
0101	5	CTRL E	CTRL U	%	5	E	U	e	u	
0110	6	CTRL F	CTRL V	&	6	F	V	f	v	
0111	7	CTRL G	CTRL W	'	7	G	W	g	w	
1000	8	CTRL~ +	CTRL X	(	8	H	X	h	x	
1001	9	TAB~	CTRL Y	)	9	I	Y	i	y	
1010	A	CTRL~ =	CTRL~ TAB	*	:	J	Z	j	z	
1011	B	CTRL -	ESC	+	;	K	[	k	☒	
1100	C	CTRL~ *	CTRL 2	,	<	L	\	l	☒	
1101	D	RET~	¦	-	=	M	]	m	☒	
1110	E	CTRL N	CTRL <	.	>	N	^	n	☒	
1111	F	CTRL O	CTRL~ >	/	?	O	_	o	☒	
ASCII	HEX									

~Another key also produces this code

V.3. Display Control Codes and Escape Sequences for the CRT

While running CP/M, there are several control sequences to enhance system operation. These control codes and escape sequences control the video display to perform sophisticated screen manipulations. The ATR8000 responds to the following codes when CP/M is running and they are sent to the CRTOUT routines in the BIOS.

CONTROL CODES

Code (hex)	Sequence	Function and Description
07	CTRL G	**Bell.** This code will sound a short tone to alert the operator.
08	CTRL H	**Backspace/ Cursor Left.** Moves the cursor back one column position (to the left) without altering the character under the cursor.
09	CTRL I	**Horizontal Tab.** Moves the cursor to the next tab stop. Tabs are preset for every eighth column.
0A	CTRL J	**Linefeed/ Cursor Down.** Moves the cursor down a line. If cursor is at bottom of screen, scrolls screen up.
0B	CTRL K	**Cursor Up.** Moves the cursor up one row without effecting the current column position. If cursor is at the top of screen, scrolls screen down.
0C	CTRL L	**Cursor Right.** Moves the cursor one column position to the right without altering the character under the cursor.
0D	CTRL M	**Carriage Return.** Returns the cursor to the first column position of the current row.
1A	CTRL Z or CTRL TAB	**Clear Screen and Home Cursor.** Clears the entire screen and places the cursor in the home position (Column 0, Row 0).
1B	CTRL [	**Escape.** The first character of an escape sequence. (Escape sequences follow.)
1E	CTRL <	**Home Cursor.** Moves the cursor to the home position (Column 0, Row 0) without otherwise effecting the screen display.
1F	CTRL >	**Display Next Character Direct.** After receiving this display code, the next character is displayed directly on the screen without interpreting it as a special display function code.

ESCAPE SEQUENCES

Code (hex)	Sequence	Function and Description
28	ESC (	**Disable Attribute Display.** Will cause all succeeding characters displayed on the screen to unconditionally have the upper bit reset, so that the selected attribute mode will not be displayed. Display will continue in this mode until changed by the "ESC)" sequence.
29	ESC)	**Enable Attribute Display.** Setting this mode will cause all following characters displayed on the screen to unconditionally have the upper bit set, thereby causing the selected attribute mode to be displayed. This mode will continue in effect until the "ESC (" mode disables it.
2A	ESC *	**Clear Screen.** Clears the screen and moves the cursor to the home position.
37	ESC 7	**Set Inverse Video Attribute Mode.** This code will not actually begin displaying inverse video characters on the screen. An ESC) sequence is used to enable the display of the attribute characters, or storing characters on the screen with the upper bit set, as described above. Thus, different attribute modes can be selected without affecting the screen display as long as there are NO characters on the screen with the upper bit set. If there are characters displayed on the screen with the upper bit set, changing attribute modes will cause an immediate change in the way the upper bit characters are displayed, depending on the attribute mode.
3D	ESC =	**XY Cursor Position Leadin.** Position the cursor to the location indicated by the following two row and column codes. The "home" position is designated as Row 0, Column 0. An offset of 20h must be added to the X and Y position codes. The positioning formula is: ESC=(X+20h)(Y+20h) where legal Y (column) values are between 0 and 79 and legal X (row) values are between 0 and 23. If a column or row position code exceeds the normal 80 column or 24 row boundaries, that row or column is set to 0.
45	ESC E	**Line Insert.** Will move the entire line the cursor resides on down one line, filling the cursor line with blank spaces, and causing the bottom line on the screen to disappear.

Code (hex)	Sequence	Function and Description
51	ESC Q	**Character Insert.** Will insert a space at the current cursor position, causing the character under the cursor and all characters after the cursor to be shifted one position to the right. The last character on the line will disappear.
52	ESC R	**Line Delete.** Similar to the line insert function. The line on which the cursor resides will be deleted from the screen and all lines below it will be moved up one line. The position of the cursor will not change.
57	ESC W	**Character Delete.** This will delete the character under the cursor and cause all characters to the right of the cursor to move one position to the left. The last character position of the line will be replaced by a space.
54	ESC T	**Clear to End of Line.** Clears all characters from the current cursor position to the end of the current line, inserting spaces. The cursor position is unchanged and the characters before the cursor are unchanged.
59	ESC Y	**Clear to End of Screen.** Clears all characters to spaces beginning with the current cursor position and ending with the end of the screen. Characters before the cursor remain unchanged and the cursor position remains the same.
3C	ESC <	**Scroll Left.** Scrolls the screen display to the left. When the first 40 character positions are displayed on the screen no further action takes place. This and the Scroll Right function allow the display of any 40 character section of the 80 character line width.
3E	ESC >	**Scroll Right.** Scrolls the screen display to the right. When the last 40 characters of a line are displayed on the screen, no further action is taken.
59	ESC Zn	**Auto Return/ Auto Scroll Up/ Auto Scroll Down/ Auto Display.** These four features of the terminal program can be turned on and off by an ESC Z sequence. The key following the sequence (n) is stored by the program and is used to control these features. Chart 3 shows the ESC Z codes.
		Auto Return. The default is on. This feature automatically performs a carriage return line feed when the cursor is in the last display column, Column 79 (the 80th column), and the terminal program is sent another character (the character goes to the first column, Column 0, of the next row).
		Auto Scroll Up. The default is on. This automatically

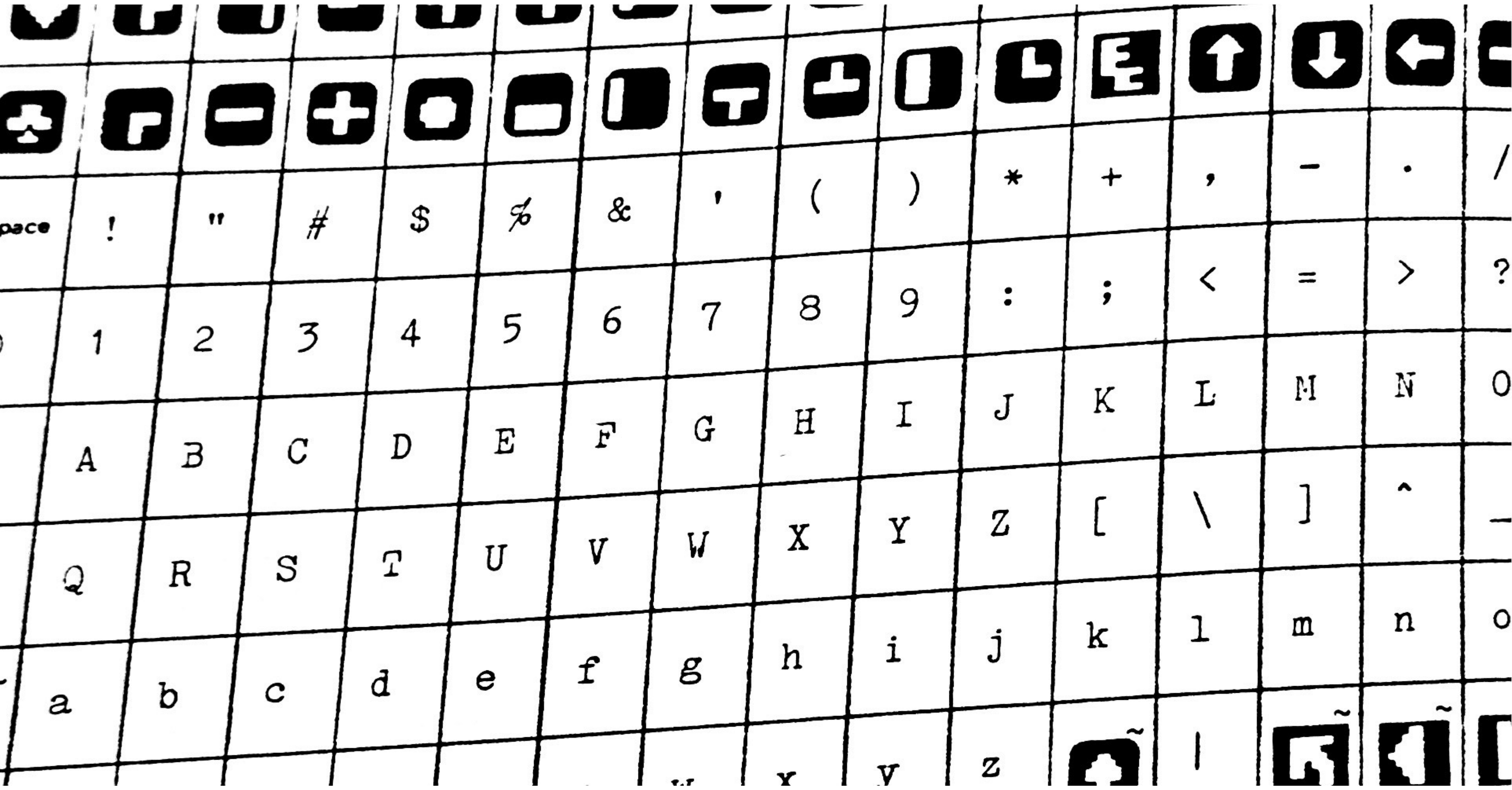
scrolls the screen up when the cursor is in the 24th row, Row 23 - the last shown row), and it is moved down.

Auto Scroll Down. The default is on. This automatically scrolls the screen down one row when the cursor is in the first row, Row 0, and it is moved up.

Auto Position. The default is off. This automatically switches the display window to show the first 40 columns of the display space, Columns 0 - 39, or to show the last 40 columns of the display space, Columns 40 - 79, depending on the location of the cursor. Thus, when the display window shows the first 40 columns, and the cursor is moved to Column 40, the display window shifts to show the last 40 columns so that the cursor is kept in view.

Chart 3: ESC Z Codes

Action Code n	Auto Return	Auto Scroll Up ↓	Auto Scroll Down ↑	Auto Display
0	ON	ON	ON	OFF
1	OFF	ON	ON	OFF
2	ON	OFF	ON	OFF
3	OFF	OFF	ON	OFF
4	ON	ON	OFF	OFF
5	OFF	ON	OFF	OFF
6	ON	OFF	OFF	OFF
7	OFF	OFF	OFF	OFF
8	ON	ON	ON	ON
9	ON	ON	ON	ON
:	ON	OFF	ON	ON
;	OFF	OFF	ON	ON
<	ON	ON	OFF	ON
=	OFF	ON	OFF	ON
>	ON	OFF	OFF	ON
?	OFF	OFF	OFF	ON



♣	┌	−	+	●	▭	▌	┬	┴	▐	└		↑	↓	←	
pace	!	"	#	$	%	&	'	(	)	*	+	,	-	.	/
	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
	Q	R	S	T	U	V	W	X	Y	Z	[	\	]	^	_
	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
							w	x	y	z		|			

The display characters in the first two lines of Chart 4, Lines 0 and 1, can only be displayed after a CTRL > sequence. This can be done by using an echo program (a program that reads in keyboard entries and sends it back) or can be done in a program running on the ATR8000. They cannot be directly accessed from the keyboard.

For example, using an echo program to display the charaacter at the coordinates 0,1 (X,Y) in this chart, you first send a CTRL >. Then you refer to the Keyboard Code chart (Chart 2) and get the code for 0,1. This code is CTRL A. Send CTRL A and the character will be displayed on the screen.

ATR8000

CP/M™ SUPPLEMENT

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